## REMARKS

Applicants amend the application and seek reconsideration thereof. In this response, Applicant amends claims 1 and 6. Applicant does not add or cancel any claims. Accordingly, claims 1-21 are pending.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attachment is captioned "Version With Markings To Show Changes Made."

The amendments to claim 1 are supported by the description and do not include any new matter. The horizontal extension of the duct is supported at page 6 lines 3-4 and page 7 lines 11-12. The duct having upper and lower walls is supported at page 7 line 11-14. The first and second heating means above and below the substrate is supported at page 9 lines 35-38. The independent heating means is supported at page 11 lines 23-25. The heating means being outside the duct is supported at page 11 lines 32-39. The first and second heating means reaching a high temperature is supported at page 8 line 11 and page 12 line 24-25. The creation of a temperature gradient is supported at page 11 lines 25-31. The added language of claim 6 is supported by the same sections.

### I. Claims Rejected Under 35 U.S.C. §103(a)

Claims 1-21 stand rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,020,474 issued to Tanaka (hereinafter "Tanaka") or U.S. Patent No. 5,442,648 issued to Ohkase (hereinafter "Ohkase").

The Examiner must show that the cited references combined teach or suggest every element of the claim. In regard to claims 1 and 6, Applicant amends claims 1 and 6 to more clearly define the invention over the cited prior art. The Attached drawing summarizes some of the features depicted in Figures 1, 4 and 5 of the application. One of the aims of the invention is to create a temperature gradient G with respect to the surfaces of the substrate 10. The gradient of temperature is created by the temperature difference between the upper surface and lower surface of the substrate. The surfaces of substrate 10 are heated by virtue of the radiation of the heat of the walls of the duct 6. This is shown in the attached drawing by the winding arrows between the

surfaces of the substrate 10 and the walls of the duct 6. The walls of the duct 6 are independently heated by the independent first and second heating elements 8 and 9. The heating of the walls are represented by winding arrows between the heating means 8 and 9 and the duct 6. Once the gradient is obtained, precursors are introduced in the flow of gas into the duct. This flow is represented by the arrow F. In the attached drawing, the upper surface of the substrate 10 is hotter than its lower surface. The gradient is therefore oriented to the upper wall of the duct. The gradient can also be null, or oriented to the lower wall of the duct. See page 11, lines 27-28.

The substrate 10 is mainly horizontal so as to allow a consistent deposition of the chemical components. The deposition is therefore possible even when the upper surface of the substrate melts. The substrate can be gently inclined as well. See page 17, lines 28-33. A precise control of the temperature and a precise heating of the surfaces of the substrate 10 are needed to control deposition. Therefore, the heating means extends above and below the surfaces of the substrate. A precise control of the gradient of temperature and of the subsequent deposition can thus be reached. The claims as amended encompass these features of the invention.

However, the cited references do not teach or suggest an apparatus with the elements as claimed in claims 1 and 6 that allow the creation of a temperature gradient. Tanaka does not teach or suggest a duct with a horizontal axis. Rather, Tanaka teaches a heating means that does not extend mainly below *and* above the surfaces of the substrate 4. See Figure 1 of Tanaka. Tanaka does not teach or suggest heating means above the surface of the substrate. The coil 5 is an induction coil and is used to heat the melt 9 on which the substrate 4 is floating. See Tanaka col. 4 lines 14. The coil 5 remains completely cold. The lower surface of the substrate 4 is heated by the melt 9. The high frequency heating coil 5 heats by induction the susceptor 7. The susceptor 7 heats in turn the melt 9. There is no material above the upper surface of the substrate 4 which can be heated by the high frequency heating means 5. Further, the reactor is made of quartz that is not heated by induction. Tanaka col. 4 line 25. The walls of the reactor 1 are not heated by the induction coil 5. Therefore, it is impossible to heat independently the lower and upper surfaces of

the substrate by virtue of the radiation of heating means placed below *and* above the surfaces of the substrate as claimed in claims 1 and 6.

Ohkase, also does not teach or suggest each of the elements of claims 1 and 6, including a duct whose axis is horizontal. Ohkase does not teach or suggest heating elements extending above *and* below the surfaces of the substrate W. Rather, Ohkase teaches a heater unit 23 that is around the middle outside periphery of the processing vessel 11 and that does not extend under the lower surface of the substrate. Thus, Ohkase does not disclose an apparatus with which it is possible to create and control a gradient of temperature.

The deposition chamber of Ohkase is divided into three parts A, B, and C. Part A is the high temperature heating portion. See col. 6 lines 26-27. Part A preheats the substrate or wafer W. When the substrate is coming up, the temperature of this part is quite high. The wafer W is thereby preheated. Once the wafer W is in place, the temperature drops. The treating temperature is maintained in part B. See col. 8 lines 59-65. Part B is a treating portion. Heat in this portion is obtained by heater unit 22 which is around the periphery of the processing vessel 11. The temperature in part C is obtained by the third heater unit 23, which is around the periphery of the processing vessel 11. Heater unit 23 has the same behavior as the second unit 22 and plays the role of a heat retaining component.

During the treatment, the temperatures in part B and C are the same. Ohkase col. 8 line 65 – col. 9 line 2. The apparatus is not designed to create a temperature gradient through the substrate W. Further, the processing vessel 11 is formed of quartz which does not constitute a material which can radiate heat to the substrate to heat one surface. The highest temperature reached is 1200 degrees Celsius. See Ohkase col. 8 line 57. The process and apparatus as claimed in claims 1 and 6 can reach a temperature of greater than 1700 degrees Celsius. See page 12 line 25. In Ohkase, high temperatures can only be reached in part A, which only heats the upper surface of the substrate. The heater means 22 and 23 cannot reach high temperatures. Thus, Ohkase does not teach or suggest an apparatus capable of creating and controlling a temperature gradient as claimed in claim 1 and inherently in claim 6. Further, Ohkase does not teach a first and second heating

means extending above and below a substrate. Thus, Ohkase does not teach each of the elements of claims 1 and 6.

The combination of Tanaka and Ohkase would not cure the defects of either in rendering claims 1 and 6 obvious. Neither reference teaches or suggests heating elements extending above and below the substrate to create a gradient of temperature. Therefore, Applicant respectfully requests reconsideration and withdrawal of the obviousness rejection of claims 1 and 6.

In regard to claims 2-5 and 7-21 these claims depend from independent claims 1 and 6 respectively and incorporate the limitations thereof. Thus, at least for the reasons mentioned in regard to claims 1 and 6 these claims are not obvious over Tanaka or Ohkase. Accordingly, reconsideration and withdrawal of the obviousness rejection of claims 2-5 and 7-21 are requested.

## CONCLUSION

In view of the foregoing, it is believed that all claims now pending, namely claims 1-21, patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

Respectfully submitted,

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Dated: June 13, 2002

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**CERTIFICATE OF MAILING:**
I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: BOX RCE, Assistant Commissioner for Patents, Washington, D.C. 20231 on June 13, 2002.

Lillian Rodriguez June 13, 2002

## VERSION WITH MARKINGS TO SHOW CHANGES MADE

### IN THE CLAIMS

Please amend the claims as follows:

1. (Amended) Process for a chemical vapor deposition of layers of a material on a substrate [(10)] which extends generally in a plane, [characterized in that it] compris[es]ing:

[a step consisting in] placing the substrate [(10)] in a horizontal duct [(6)] made of a refractory material; [in which are flowing gaseous compounds necessary for the deposition, this duct (6) being interposed between the substrate (10) and first (8) and second (9) heating means located on either side of the plane of the substrate (10); ]

heating independently an upper and lower wall of the duct by a first and second heater, the first and second heater extending above and below the substrate, outside the duct;

[a step consisting in] heating independently an upper and lower surface of the substrate [(10)] by [virtue of the] radiation [from the] of heat from at least one wall of the duct [(6)] raised to a temperature substantially higher than ambient temperature;

creating a temperature gradient with respect to the upper and lower surface of the substrate; [, which is itself heated by the first (8) and second (9) heating means; and]

emitting compounds in a gaseous form into the duct; and

[a step of] depositing the compounds on the substrate[, the compounds coming from the flow of gas].

2. (Twice Amended) Process according to claim 1, further [characterized in that it] compris[es]ing:

[a step consisting in] placing at least one heat shield [(14, 15)] around the first [(8)] and second [(9)] heater[ing means], [this] the at least one heat shield being concentric with respect to the duct and situated outside the first and second heater[ing means].

3. (Twice Amended) Process according to claim 1, [characterized in that it] wherein [comprises a step consisting in generating a] the temperature gradient is perpendicular to the plane of the substrate [(10)] and oriented in a first direction.

4. (Amended) Process according to claim 3, [characterized in that it] further compris[es]ing: [a step consisting in] reversing the first direction of the temperature gradient [with respect to the first direction].

5. (Amended) Process according to claim 1, [characterized in that it] further compris[es]ing: [a step consisting in] creating a flow of a gas which is inert with respect to all [of the] materials included in [the] a reactor and with respect to the material to be deposited and to the [gases flowing in the duct (6)]compounds in a gaseous form.

6. (Amended) Reactor for a chemical vapor deposition of layers of a material on a substrate [(10)] which extends [mainly] generally in a plane, comprising:

a horizontal duct made of refractory material;

independent first [(8)] and second [(9) heating] means for heating an upper wall and lower wall of the duct to a temperature substantially higher than ambient temperature, the first and second means for heating extending above and below the substrate, and outside the duct; and

means to emit [located on either side of the plane of the substrate (10), characterized in that it furthermore comprises a duct (6), made of a refractory material in which are flowing] [gaseous] compounds in a gaseous form [necessary for the deposition, this] into the duct [(6)] [being interposed between the substrate (10) and the first (8) and second (9) heating means].

7. (Amended) Reactor according to claim 6, [characterized in that] wherein the first [(8)] and second [(9) heating] means for heating [consist of] include a [bare] resistive element[s].

8. (Twice Amended) Reactor according to claim 6, [characterized in that] wherein the duct [(6)] has a rectangular cross section and [comprises] includes two plates forming a lower wall

[(37)] and an upper [(38)] wall[s] which are horizontal and parallel to the plane of the substrate [(10)] in [the] a position that [it] the substrate occupies during [the] a deposition.

9. (Amended) Reactor according to claim 6, [characterized in that it] further compris[es]ing: at least one heat shield [(14, 15)] around the first [(8)] and second [(9) heating] means for heating.

10. (Amended) Reactor according to claim 9, [characterized in that the assembly consisting of] wherein the duct [(6)], the first [(8)] and second [(9) heating] means for heating and [each] the at least one heat shield [(14, 15) is] are [placed] in a tube[ (3)].

11. (Amended) Reactor according to claim 10, [characterized in that] wherein the duct [(6) is held in place in the tube (3) so as to be free of any] does not contact [with] the tube[(3)].

12. (Twice Amended) Reactor according to claim 10, [characterized in that gas may be made] wherein the reactor is configured to pass the compounds in a gaseous form via [the] an outlet of the duct [(6)] between [the] an internal space of the duct [(6)] and [the] a space lying between the duct [(6)] and the tube [(3)],[ so as] to balance [the] a pressure on [the] at least one wall[s (37, 38, 39, 40)] of the duct[ (6)].

13. (Amended) Reactor according to claim 12, [characterized in that] wherein at least one [the] wall[s (37, 38, 39, 40)] of the duct [(6) have] has a thickness of less than or equal to one millimeter.

14. (Twice) Reactor according to claim 8, [characterized in that] wherein the first [(8)] and second [(9) heating] means for heating [consist of ]include a graphite strip or band placed flat[,] and parallel to the lower wall [(37)] and upper [(38)] wall[s] of the duct [(6)], in a [suitable] geometry so that, in [the] a deposition zone, [the] a deviation[s] from the mean temperature on [that] a surface of the substrate [(10) which is intended for the deposition] is [are] less than 3°C.

15. (Twice Amended) Reactor according to claim 8, [characterized in that] wherein the first [(8)] and second [(9) heating] means for heating are positioned, outside the duct [(6) each] at a distance of 1 to 3 mm from one of the lower wall [(37)] or the upper [(38)] wall[s, respectively].

16. (Twice Amended) Reactor according to claim 6, [characterized in that] wherein the first [(8)] and second [(9) heating] means for heating may be raised to different temperatures.

17. (Twice Amended) Reactor according to claim 6, [characterized in that] wherein the first [(8)] and second [(9)] means for heating form only a single heating device placed [all] around the duct [(6)].

18. (Twice Amended) Reactor according to claim 6, [characterized in that] wherein the first [(8)] and second [(9)] means for heating [means ]are placed in [the] a region of [the] a deposition zone.

19. (Twice Amended) Reactor according to claim 6, [characterized in that] wherein the means for heating [means (8, 9) are] is supplied with a voltage of less than or equal to 230 volts.

20. (Twice Amended) Reactor according to claim 6, [characterized in that] wherein the duct [(6)] is internally lined[, in the hottest parts, continuously with] in a first portion with a secondary duct made of a refractory material.

21. (Twice Amended) Reactor according to claim 6, [characterized in that] wherein the first [(8)] and second [(9)] means for heating [means] are offset with respect to each other in [the] a longitudinal direction of the duct[ (6)].